

- the same specificity as the heavy chain, to produce a first antibody molecule containing said introduced cysteine residue;
- (iii) purifying said first antibody molecule from said host cell or expression system;
 - (iv) contacting said purified first antibody molecule with an amount of a suitable reducing agent sufficient to partially reduce the intra or inter molecular disulfide bonds of said first antibody molecule to thereby enhance dimerization of said first antibody molecule with a second antibody molecule; and
 - (v) contacting said purified first antibody molecule with a second antibody molecule, wherein said second antibody has a binding specificity to a second antigen, wherein said second antibody contains a thiol reactive group other than a cysteine group introduced therein; and allowing sufficient time for dimerization to proceed; to thereby produce an antibody heterodimer comprised of said first antibody molecule and said second antibody molecule, wherein each antibody molecule retains its binding specificity following dimerization.

24. (Three Times Amended) A method for producing an antibody heterodimer comprising:

- (i) obtaining or constructing a DNA molecule that encodes an antibody molecule heavy chain that has binding specificity to a first antigen when said heavy chain is paired with a corresponding light chain, and introducing at least one cysteine codon into said antibody molecule heavy chain via recombinant DNA mutagenesis, wherein the location of said cysteine does not interfere with the antigen binding properties of said heterodimer;
- (ii) expressing said DNA molecule in a suitable host cell, or expression system, together with a DNA molecule that encodes an antibody molecule light chain having the same specificity as the heavy chain, to produce a first antibody molecule containing said introduced cysteine residue;
- (iii) purifying said first antibody molecule from said host cell or expression system;
- (iv) contacting said purified first antibody molecule with an amount of a suitable

bonds of said first antibody molecule to thereby enhance dimerization of said first antibody molecule with a second antibody molecule; and

(v) introducing a thiol reactive group on a second antibody molecule, wherein said second antibody has a binding specificity to a second antigen, and wherein said second antibody does not have a cysteine group introduced therein; and allowing sufficient time for dimerization to proceed; to thereby produce an antibody heterodimer comprised of said first antibody molecule and said second antibody molecule, wherein each antibody molecule retains its binding specificity following dimerization.

28. (Twice Amended) An IgG/IgG dimer produced by the method of Claim 24, wherein said IgGs are of the same or different IgG subclass.

41. (Twice Amended) A pharmaceutical composition comprising an IgG/IgG dimer according to Claim 24, and a pharmaceutically acceptable carrier.

45. (Twice Amended) A method for producing an IgG/IgG heterodimer comprising preparing a first IgG MAb having binding specificity to a first antigen, introducing a cysteine residue in said first IgG MAb at a position which does not interfere with the antigen binding properties of said heterodimer, and which inhibits or prevents formation of an intramolecular disulfide bridge between sister heavy chains on the same antibody molecule, and exposing said first IgG MAb to a second IgG MAb having a binding specificity to a second antigen, whereby said first and second IgG MAbs dimerize to produce said IgG/IgG heterodimer comprised of said first IgG MAb and said second IgG MAb, wherein each IgG retains its binding specificity following dimerization.